CLAIMS

1. A non-volatile memory comprising:

a first electrode;

a second electrode; and

a phase-change recording medium sandwiched between the first electrode and the second electrode, in which resistance value is varied by application of an electrical pulse across the first electrode and the second electrode; wherein

at least one of the first electrode and the second electrode contains as a main ingredient at least one member selected from the group consisting of ruthenium, rhodium and osmium; and

the phase-change recording medium is formed from a phase-change material containing chalcogen(s).

2. A non-volatile memory according to Claim 1, wherein at least one of the first electrode and the second electrode contains ruthenium as a main ingredient.

3. A non-volatile memory according to Claim 2, wherein the phase-change recording medium is formed of GeSbTe.

4. A non-volatile memory according to Claim 1, wherein

an insulating layer lies between the first electrode and the second electrode;

the insulating layer comprises a throughhole; and

the phase-change recording medium comprises a standing portion filling the throughhole.

5. A non-volatile memory according to Claim 4, wherein the standing portion has a straight tube shape.

6. A non-volatile memory according to Claim 4, wherein

the phase-change recording medium further comprises a layered portion sandwiched between the insulating layer and either the first electrode or the second electrode; and

the standing portion is formed so as to extend from the layered portion in a substantially perpendicular direction.

7. A non-volatile memory according to Claim 4, which further comprises an insulating tube that is formed along the inner surface of the throughhole and that

has a thermal conductivity lower than that of the insulating layer.

8. A non-volatile memory according to Claim 1, wherein a metal-oxide layer containing at least one member selected from the group consisting of ruthenium, rhodium, iridium and osmium lies between at least one of the pairs of the first electrode and the phase-change recording medium, and the phase-change recording medium and the second electrode.

9. A non-volatile memory according to Claim 8, wherein a rough surface is provided on the metal-oxide layer in the region where it comes into contact with the phase-change recording medium.

10. A non-volatile memory according to Claim 9, wherein the surface where the metal-oxide layer comes into contact with the phase-change recording medium has an average roughness (Ra) of from not smaller than 10 nm to not greater than 100 nm.

11. A non-volatile memory according to Claim 9, wherein

the metal-oxide layer has a multi-layered

structure comprising a first conductive oxide film that has a small average grain size or that is amorphous and a second conductive oxide film that has an average grain size greater than that of the first conductive oxide film; and

the surface of the second oxide conductive film is structured so as to contact with the phase-change recording medium.

12. A non-volatile memory according to Claim 8, wherein the metal-oxide layer is a conductive oxide layer having a tetragonal rutile structure.

13. A non-volatile memory according to Claim 1, which further comprises a substrate and an insulating layer formed on the substrate, wherein

the insulating layer comprises a throughhole;

the first electrode fills in the throughhole; and

the phase-change recording medium forms a layered structure on the surface of the insulating layer.

14. A non-volatile memory according to Claim 13, wherein a metal-oxide layer containing at least one member selected from the group consisting of ruthenium,

rhodium, iridium and osmium lies between at least one of the pairs of the first electrode and the phase-change recording medium, and the phase-change recording medium and the second electrode.

15. A non-volatile memory according to Claim 14, wherein a rough surface is provided on the metal-oxide layer in the region where it comes into contact with the phase-change recording medium.

16. A non-volatile memory according to Claim 15, wherein the surface region where the metal-oxide layer comes into contact with the phase-change recording medium has an average roughness (Ra) not smaller than 10 nm to not greater than 100 nm.

17. A non-volatile memory according to Claim 15, wherein

the metal-oxide layer has a multi-layered structure comprising a first oxide conductive film that has a small average grain size or that is amorphous and a second oxide conductive film that has an average grain size greater than that of the first oxide conductive film; and

the surface of the second oxide conductive film

is structured so as to contact with the phase-change recording medium.

18. A non-volatile memory according to Claim 13, which further comprises an insulating tube that is formed along the inner surface of the throughhole and that has a thermal conductivity lower than that of the insulating layer.

19. A method for fabricating a non-volatile memory comprising the steps of:

forming a first electrode that contains as a main ingredient at least one member selected from the group consisting of ruthenium, rhodium and osmium on a substrate having an insulator in between;

forming an insulating layer on the first electrode;

forming a throughhole in the insulating layer by photolithography;

forming a phase-change recording medium that comprises a standing portion filling in the throughhole and a layered portion formed on the surface of the insulating layer by depositing a phase-change material containing chalcogen(s) on the insulating layer; and

forming a second electrode that contains as a

main ingredient at least one member selected from the group consisting of ruthenium, rhodium and osmium on the phase-change recording medium.

20. A method for fabricating a non-volatile memory according to Claim 19, which further comprises a step for forming a first metal-oxide layer between the steps for forming the throughhole and forming the phase-change recording medium, wherein

the formation of the first metal-oxide layer is conducted by oxidizing the portion of the first electrode exposed by the throughhole.

21. A method for fabricating a non-volatile memory according to Claim 19, which further comprises a step for forming a second metal-oxide layer between the steps for forming the phase-change recording medium and forming the second electrode, wherein

the second metal-oxide layer and the second electrode are formed by sequential sputtering under an oxygen atmosphere and under an inert gas atmosphere respectively in the same sputtering apparatus.

22. A method for fabricating a non-volatile memory according to Claim 19, which further comprises a

step for forming a first metal-oxide layer between the steps for forming the first electrode and forming the insulating layer, wherein

the first electrode and the first metal-oxide layer is formed by sequentially sputtering under an inert gas atmosphere and an oxygen atmosphere respectively in the same sputtering apparatus.

23. A method for fabricating a non-volatile memory according to Claim 19, which further comprises a step for forming an insulating tube along the inner surface of the throughhole between the steps for forming the throughhole and forming the phase-change recording medium, wherein

the step for forming the insulating tube is conducted by etching back an insulating-material coating film that is formed on the surface of the insulating layer.

24. A method for fabricating a non-volatile memory comprising the steps of:

forming a metal wiring film on a substrate having an insulator in between;

forming an insulating layer on the metal wiring film;

forming a throughhole in the insulating layer by

photolithography;

forming a first electrode that fills in the throughhole by depositing a high-melting-point metal that contains as a main ingredient at least one member selected from the group consisting of ruthenium, rhodium and osmium on the insulating layer, and selectively leave the high-melting-point metal in the throughhole;

forming a phase-change recording medium having a layered structure on the surface of the insulating layer by depositing a phase-change material that contains chalcogen(s) on the insulating layer; and

forming a second electrode that contains as a main ingredient at least one member selected from the group consisting of ruthenium, rhodium and osmium on the phase-change recording medium.

25. A method for fabricating a non-volatile memory according to Claim 24, which further comprises a step for forming a first metal-oxide layer between the steps for forming the first electrode and forming the phase-change recording medium, wherein

the metal-oxide layer is formed by oxidizing the exposed portion of the first electrode.

26. A method for fabricating a non-volatile

memory according to Claim 24, which further comprises a step for forming a second metal-oxide layer between the steps for forming the phase-change recording medium and forming the second electrode, wherein

the second metal-oxide layer and the second electrode are formed by sequential sputtering under an oxygen atmosphere and an inert gas atmosphere respectively in the same sputtering apparatus.

27. A method for fabricating a non-volatile memory according to Claim 24, which further comprises a step for forming a first metal-oxide layer between the steps for forming the first electrode and forming the phase-change recording medium, wherein

the first electrode and the first metal-oxide layer are formed by sequential sputtering in an inert gas atmosphere and an oxygen atmosphere respectively in the same sputtering apparatus.

28. A method for fabricating a non-volatile memory according to Claim 24, which further comprises a step for forming an insulating tube along the inner surface of the throughhole between the steps for forming the throughhole and forming the first electrode, wherein

the step for forming the insulating tube is

conducted by etching back an insulating-material coating film formed on the surface of the insulating layer.